

REMARKS

Claims 6-21 are all the claims pending in the application. Applicants cancel claims 1-5, amend claims 6-14 and add claims 15-21 by way of this Amendment.

Claim Objections:

All the claims appear to be objected to because of informalities.¹ Applicants amend the claims to remove any ambiguities.

In addition, page 12 of the specification is amended in view of these claim changes. No new matter is added since these features are clearly supported by the drawing figures as originally filed.

Claim Rejections:

Claims 1-10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Takahashi et al. (6,096,405).

Claims 1-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tanabe (6,555,273) in view of Takahashi et al. (6,096,405).

Analysis

Applicants respectfully request the Examiner to reconsider and withdraw the prior art rejections in view of the attached claim amendments and the following remarks.

¹ Although the specific claims are not indicated, the Examiner's comment regarding "back" surface would refer to all the claims.

Claim 6

The claimed invention is directed to a photomask blank for preparing a photomask for a display device. The photomask blank comprises a substrate and an opaque layer. The substrate has a square shape, with a chamfered surface formed between a first surface and the edge surface, and between a second surface and the edge surface. Each side length of the square shape is at least 300 nm and weighs 1 – 15 kg. The edge and chamfered surfaces have a roughened surface having a roughness Ra of 0.03 to 0.3 micrometer.

The present invention solves the problems due to the substrate having this predetermined size and weight required for use for the photomask and photomask blank. That is, the present invention sets the optimum surface roughness as the claimed range in order to avoid the dangers of having the substrate slip off a technician's hand during handling of the substrate. In addition, the invention avoids the generation of particles from the end surface and the chamfered portion, which brings defects in a mask particle of the final product.

Takahashi

Cited prior art reference Takahashi is directed to a magnetic disc which can prevent the generation of thermal asperity.

Thermal asperity is a phenomenon of heat generation at a magnetic head when particles are adhered to a surface of the magnetic disc which is rotating at high speed, and this thermal asperity brings problems such as varying resistance of the head. This thermal asperity is a characteristic problem of the magnetic disc.

In order to prevent thermal asperity from occurring, according to Takahashi, it is required that the surface roughness on the side wall portion and chamfered portion of the glass substrate

are as small as possible, and preferably, the surfaces are required to be mirror surfaces. As discussed at the first paragraph of col. 2, for instance, Takahashi states “the side end surface must be precisely polished by mechanical polishing to avoid generation of the particles.”

Thus, the surface roughness of Takahashi is proposed for the purpose of preventing the generation of the thermal asperity which is generated in the magnetic disc which is rotating at high speed.

Tanabe

Tanabe discloses a photomask. The photomask has a square shape of 152mm and thickness of 6mm. There is no discussion of a preferred surface roughness. This reference only discloses that the principal surface and the side surface are “precisely polished”.

Differences between Claim 6 and the Cited Prior Art

As noted above, the claimed invention is directed to a relatively large photomask blank for display device manufacturing rather than magnetic recording mediums. Thus, the present invention is concerned with completely different purposes and operations than Takahashi and Tanabe.

Although the surface roughness of Takahashi partially overlaps with the claimed invention, it is proposed for preventing generation of thermal asperity which is generated in the magnetic disc operating at high speed. On the other hand, the substrate of the present invention is for use in a photomask. In the substrate for the photomask, the problem of thermal asperity never occurs. Therefore, it is not obvious to apply the surface roughness of Takahashi, which has a totally different purpose and problem, to the substrate of the present invention. That is the

motivation for using the surface roughness in Takahashi is not applicable to a substrate having a larger size and for the use of the present invention.

Moreover, the surface roughness disclosed in Takahashi is relevant for a small sized substrate that is lightweight and easier to handle. Since the magnetic disc of Takahashi has a diameter of only 96mm and a thickness of 3mm, when the skilled person in the art considers a substrate having a size of 300mm or more, and a weight of 1 – 15 kg, the person of skill in the art would find it difficult to even predict what kind of technical problems occur in the larger substrate based on the teachings of Takahashi.

On the other hand, in the field of large substrates, it has previously not been taught to have a very smooth end surface because it makes it hard to handle the heavy substrates, and moreover, it interferes with the use of the mask aligner. (See Background portion of pending application.)

Tanabe does not discuss surface roughness, and is directed to a much smaller substrate. Thus, this reference provides no further motivation for modifying Takahashi to arrive at the present invention.

In view of the foregoing, the claimed invention as a whole would not have been obvious. That is, it would not have been obvious to combine the claimed surface roughness with the relatively large sized substrate of the present invention in view of the cited references. That is, the motivation for using the surface roughness in Takahashi is not applicable to the larger substrate used for the photomask in the present invention.

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Thus, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of claim 6.

Dependent Claims 8-10 and 15-17

Applicants add claims 15-17 to further define the invention. These claims clarify the surface roughness characteristics of the substrate.

Claims 8-10 and 15-17 are patentable for at least the same reasons as claim 6, by virtue of their dependency therefrom.

Differences between Claim 7 and the Cited Prior Art

Claim 7 is patentable for similar reasons to claim 6. Namely, the cited references do not teach or suggest having a substrate having the claimed size and weight with the claimed surface roughness. Takahashi suggests its surface roughness to prevent the generation of thermal asperity which is generated when a magnetic disc rotates at high speed. On the other hand, the substrate of the present invention is for use in a photomask, and the problem of thermal asperity does not occur. Thus, the motivation for utilizing the surface roughness in Takahashi does not apply to a larger sized substrate as in the present invention for a photomask.

Thus, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of claim 7.

Dependent Claims 18-21

Applicants add claims 18-21 to further define the invention. These claims clarify the use of the abrasive tool for forming the surface roughness of the substrate and the surface roughness characteristics of the substrate. These claims are patentable for at least the same reasons as claim 7 by virtue of their dependency therefrom.

Independent Claims 11 and 13

Claims 11 and 13 are patentable for similar reasons to claims 6 and 7 above. In particular, the chamfered surfaces of the claimed substrate are roughened surface polished with an abrasive tool having a particle size ranging from #700 to #2400.

In order to have a roughened surface having a surface roughness Ra falling within an acceptable range, an abrading tool having a grain size of #700 to #2400 is used.

It would not have been obvious to polish the chamfered portions of a substrate having the size and weight of the claimed invention with an abrasive tool having this particle size range because the prior art is only concerned with preventing the generation of thermal asperity, which is not a concern with the larger sized substrates as those used in the claimed invention.

Thus, Applicants respectfully request the Examiner to reconsider and withdraw the rejections of claims 11 and 13.

Claims 12 and 14

Claims 12 and 14 are patentable for similar reasons to those discussed above. Here, the chamfered surfaces have a smaller surface roughness than the edge end surface. However, it would not have been obvious to apply this surface roughness characteristic to the substrate in Takahashi because Takahashi is only concerned with preventing thermal asperity. This is not a concern for photomask blanks used in preparing a photomask for a display device. Thus, Takahashi's rationale for having the claimed surface roughness characteristics would not apply to a photomask having the physical structure of the claimed invention.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

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Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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